

**REMARKS**

Entry of the foregoing and reexamination and reconsideration of the subject application, as amended, pursuant to and consistent with 37 C.F.R. § 112, are respectfully requested in light of the following remarks.

Claims 21-26, 28, and 31-39 are pending in this application.

Claims 1-20 were previously cancelled. Claims 27, 29 and 30 have been cancelled in this amendment.

Claim 22 has been amended to incorporate the subject matter of claim 30, which depended from claim 27 which depended from claim 22.

No new matter has been added in making these amendments.

**35 U.S.C. §103(a) Obviousness Rejections**

1. Claims 21-36, 38 and 39 have been rejected under 35 U.S.C. §103(a) as unpatentable over Onopchenko et al. (U.S. Patent 4,032,569) in view of Gaige et al. (U.S. 20030032825).

Applicants respectfully submit that Claims 21-36, 38 and 39 are not obvious over Onopchenko et al. in view of Gaige et al.

To establish a *prima facie* case of obviousness, three basic criteria must be met. (MPEP 2143) First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Onopchenko teaches a process for the oxidation of cyclohexane to adipic acid using cobaltic ions. (col. 1, lines 5-13 and 31-33) Onopchenko teaches cooling the reaction mixture at the end of the reaction period, diluting the reaction mixture with water, heating the reaction mixture to which the water was added until cobaltous ions were present, and then evaporating the mixture to dryness. The dried residue was then extracted with acetone to separate the products from the catalyst. (col. 3, lines 1-12) Onopchenko further teaches:

The organic products will contain the desired adipic acid and smaller amounts of glutaric and succinic acids. The individual acids can be separated from each other in any conventional manner, for example, by crystallization from conventional solvents such as benzene or water. (Page 3, lines 12-17)

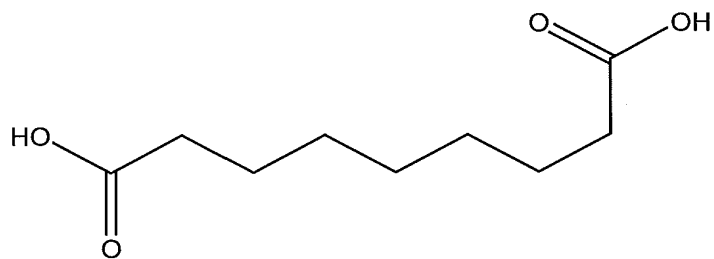
Onopchenko teaches away from modifying the process using the teachings of Gaige by teaching that the desired acids can be separated by crystallization. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F3d 551, 553, 31 USPQ2d 1130, 1131. (Fed. Cir. 1994) One of ordinary skill in the art upon reading Onopchenko would not be motivated to change the process from purifying the desired compound by crystallization to the elaborate process described in Gaige, which requires prepurifying the product before performing the extraction. (The processes required in Gaige are described below.)

The Office Action states:

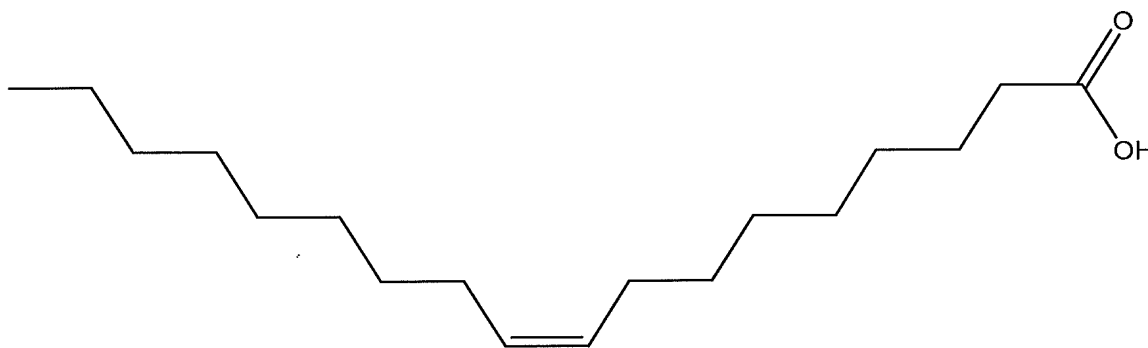
Although Onopchenko teaches a liquid extraction of a solid residue to obtain adipic acid and at the end of the reaction period the reaction mixture can be separated into its component parts by any

convenient means, Onopchenko does not teach other convenient means which can be used to obtain adipic acid. (page 3, paragraph 2).

Gaige teaches a method of purifying azelaic acid, which is also known as nonanedioic acid. Gaige teaches that azelaic acid is manufactured by the ozonization or oxidation of mixtures of fatty acids containing oleic acid.



azelaic acid



oleic acid

Gaige also teaches:

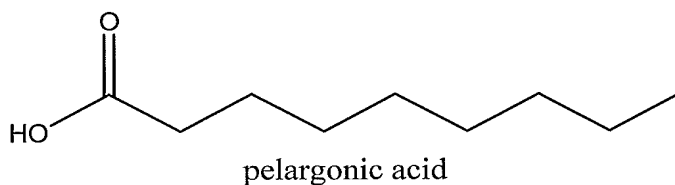
The process of the present invention includes separation of an azelaic acid mixture (hereinafter prepurified azelaic acid) from the major portion of pelargonic acid formed in the process and lower boiling point carboxylic acids and higher boiling point residue to form the prepurified azelaic acid mixture, feeding the prepurified azelaic acid mixture into a central portion of a dual extraction zone wherein the prepurified azelaic acid is continuously contacted with an aqueous phase and a water immiscible solvent phase to form an aqueous phase containing the azelaic acid and water soluble carboxylic acids and a water immiscible solvent phase containing the monocarboxylic acids and a portion of the dicarboxylic acids having a chain-length of 9 or greater and recovering the azelaic acid from the aqueous phase. (page 2, paragraph [0013])

One of ordinary skill in the art, upon reading the above paragraph would realize that that the method of Gaige was use to separate azelaic acid and water soluble carboxylic acids from monocarboxylic acids and a portion of the dicarboxylic acids having a chain-length of 9 or greater.

The Office Action states:

Gaige ... teaches a method for purifying azelaic acid, which is a dicarboxylic acid wherein in the process of the invention, the prepurified azelaic acid is introduced into the central portion of a dual extraction apparatus. The aqueous phase is introduced into one end of the extraction apparatus and a water immiscible solvent for the monocarboxylic acid is introduced into the opposite end of the extraction apparatus. Since the water immiscible solvent is generally a non-polar hydrocarbon material with a specific gravity lower than water, it is introduced into the bottom portion of the extraction column. The operation of the extractor will be described in relation to use of a water immiscible solvent for the monocarboxylic acids having a specific gravity lower than that of the aqueous phase. However, it must be realized that it is possible to use water immiscible solvents having specific gravities higher than the aqueous phase. (page 3, third paragraph).

The instant claims require extracting the dicarboxylic acid formed in the oxidation step from the reaction medium. However, Gaige does not extract azelaic acid from the reaction mixture but rather separates a "purified azelaic acid" from the major portion of pelargonic acid formed in the process.



Gaige separates a minor reaction product (azelaic acid) from the major reaction product, not from the reaction mixture. Gaige teaches:

Prepurification of the mixed oxidation products is necessary since more than 50% by weight of the oxidation product is pelargonic acid which is produced by the ozonization and oxidation ..." (paragraph [0023])

In Gaige, the reaction mixture is distilled to separate starting materials and a variety of impurities having boiling points lower than azelaic acid (paragraph [0045]) and higher than azelaic acid (paragraph [0046]) from the azelaic acid. The "prepurified azelaic acid" formed has been separate from the starting material and numerous products which are part of the reaction mixture before being purified by extraction. Gaige does not teach a process for producing a dicarboxylic acid comprising a step in which the dicarboxylic acid is produced by oxidizing a cycloaliphatic hydrocarbon with oxygen or a gas containing oxygen in a reaction medium comprising an oxidation catalyst and a lipophilic oxidation solvent. Gaige teaches producing azelaic acid by the ozonation and oxidation of unsaturated fatty acids. This reaction is completely distinct from step (a) of the claimed process which requires producing a dicarboxylic acid by oxidizing a cycloaliphatic hydrocarbon with oxygen or a gas containing oxygen in a reaction medium comprising an oxidation catalyst and a lipophilic oxidation solvent. The starting material in Gaige is of a different class (unsaturated fatty acids) than that required by the instant claims (a cycloaliphatic hydrocarbon). As such, one of ordinary skill in the art would recognize that due to the differences between the nature of the reactants and the reaction, purification processes would not be expected to be the same.

The Office Action alleges that it would have been obvious to use the extraction method as taught by Gaige to extract the dicarboxylic acid as taught by Onopchenko because the conventional extraction process has a high yield and highly pure dicarboxylic acid. (Page 3, least paragraph) An evaluation of Table 1 of Gaige shows that the aqueous phase contains about 80% of the C9 di-acids, about 5% of <C8 diacids, about 4% C8 diacids, about 3% C10 diacids and about 7% of the >C10 diacids. The purity of the desired product (about 80%) is comparable to the purity obtained in Onopchenko (about 80% as seen in Tables I and II). Therefore there would not have been a reason to modify Onopchenko with Gaige based on purity of the product, since they both had similar purities.

The Office Action further alleges that is would have been obvious to optimize the solvents to obtain a highly pure yield of the final product. (page 4, first paragraph) Applicant notes that Gaige does not provide any information on the yield of the product, but rather provides in Table I the percentage composition of the aqueous and organic phases. There is nothing in Gaige that indicates that a higher yield was found in the process of Gaige, or that the yield in the process of Onopchenko would be improved by using the process of Gaige.

The Office Action indicates that Gaige teaches in paragraph [0044] that the process can also be applied to the recovery of a dicarboxylic acid other than azelaic acid from a reaction mixture formed by oxidation of an unsaturated carboxylic acid other than oleic acid. Paragraph [0044] describes the process where the reaction medium is distilled to separate the lower and higher boiling materials from the "prepurified azelaic acid". One of ordinary skill in the art would recognize that Gaige

teaches that such "prepurification" steps would still need to be performed with other compounds.

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. There is no suggestion or motivation in the cited prior art to modify Onopchenko to extract the acids from the reaction mixture as required by the instant claims. There is nothing in Gaige that provides any suggestion or motivation to extract the reaction medium formed in Onopchenko. Nor has the Office Action provided any such motivation. The Office Action has not recognized that the Gaige is not extracting the compound from the reaction medium, as required by the claims, but rather is extracting a purified material formed after various components have been removed. As shown above, Gaige does not teach or suggest extracting the reaction medium and actually teaches against such a procedure by teaching the need to form a "prepurified azelaic acid" from which the reaction medium has been removed. Therefore there is no motivation or suggestion in the cited prior art to modify the invention of Onopchenko with Gaige to obtain Applicant's invention.

To establish a *prima facie* case of obviousness, there must be a reasonable expectation of success. There is no reasonable expectation of success in obtaining the Applicant's claimed emthods by making changes to the process of Onopchenko based on the teachings of Gaige. There is nothing in the cited prior art that indicates there would be a reasonable expectation of success in performing the extraction as claimed. As indicated above, Onopchenko does not perform a liquid-liquid

extraction, but rather forms an extraction of a dry residue. The Office Action acknowledges that Onopchenko does not teach such a step. Gaige also does not teach the step of extracting a reaction mixture. In fact Gaige teaches away from such a step by requiring the removal of compounds with lower and higher boiling points than azelaic acid in order to form a "prepurified azelaic acid", which is then purified by an extraction procedure. One of ordinary skill in the art would not have expected that the reaction mixture could be extracted using the claimed method when Gaige requires the use of a "prepurified azelaic acid", in which many of the materials present in the reaction mixture had been removed by distillation to separate the "prepurified azelaic acid" from compounds of lower and higher boiling points. Such a person would recognize that the presence of the removed materials could impact the extraction of the desired material. Such a person would also recognize that Gaige would not have required the various distillation procedures to remove numerous compounds to form the "prepurified azelaic acid" if such an extraction could have been performed from the reaction medium without the various distillations. Therefore, there was no reasonable expectation of success at the time of the invention that the claimed method could be obtained by modifying Onopchenko with Gaige.

To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Neither of the prior art references teach or suggest extracting the dicarboxylic acid from the reaction medium, as required by the claims. Nor do they teach or suggest extracting the dicarboxylic acid formed from the reaction medium in a countercurrent-flow liquid/liquid extraction column using a second extraction solvent which is the



cycloaliphatic hydrocarbon to be oxidized. Therefore the cited prior art does not teach or suggest all of the limitations of the instant claims.

Therefore, in consideration of the foregoing, Applicants respectfully submit that Claims 21-36, 38 and 39 are not obvious over Onopchenko et al. in view of Gaige et al. Applicants therefore request that this rejection be withdrawn.

2. Claim 37 has been rejected under 35 U.S.C. §103(a) as unpatentable over Onopchenko et al. in view of Gaige, as applied to claim 36, and further in view of Constanti et al. (U.S. Patent 5,756,837).

Applicants respectfully submit that Claim 37 is not obvious over Onopchenko et al. in view of Gaige, as applied to claim 36, and further in view of Constanti et al.

The teachings of Onopchenko and Gaige have been described above.

Claim 37 depends from claim 36, which depends from claim 22. It was shown above that claims 22 and 36 are not obvious over Onopchenko in view of Gaige. The addition of Constanti does not overcome the deficiencies in Onopchenko and Gaige. Claim 37 is not obvious over Onopchenko and Gaige because, as shown above, claim 22 and 36 from which it depends is not obvious over these references. Applicants therefore request that this rejection be withdrawn.

Applicants therefore respectfully request the withdrawal of all of these rejections.

In view of the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order. Such action is earnestly solicited.

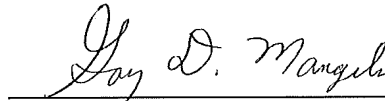
In the event that there are any questions related to this response, or the application in general, it would be appreciated if the Examiner would telephone the undersigned attorney at the below-listed telephone number concerning such questions so that prosecution of this application may be expedited.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

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